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THE UTILIZATION OF THE BY-CATCH OF FISH
FROM SHRIMP TRAWLING IN TROPICAL AREAS

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The opinions expressed in this paper are those of the author and do not necessarily represent those of the International Development Research Centre. This paper is a shortened version of a detailed document on this subject (with references) now under preparation.

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ABSTRACT

The paper draws attention to the change in policy and attitude with regard to the processing of industrial fish from fish which can be consumed directly. Less developed countries have placed greater emphasis on self-sufficiency in food. An area of special concern is the waste from the by-catch of shrimp trawlers operating off tropical coasts where the total catch of edible fish jettisoned at sea is estimated at 5 million tons annually. It is explained that the current design and operating system of shrimp trawlers leave little alternative since profitability of handling fish as well as shrimp are unattractive. Technological solutions are discussed and the experiences in Guyana and S. E. Asia are cited. Since the areas of greatest need are in tropical countries it is urged that a concerted effort be made on this particular problem.

Introduction

The impending world food and population situation has made it imperative that the most effective use of all available fish resources for human consumption should be carefully reviewed. The maximum benefits must be derived particularly in tropical areas where there is animal protein deficiency in food consumed. It has been the expressed concern of many developing countries that mechanized fishing off their shores remove large quantities of fish which, whether as fishmeal or quality products, are destined for the consumption of more developed and much richer countries where there is no animal protein malnutrition or even food shortage. Such fish does not enter into the economy of the coastal countries. The historical attitude towards fishmeal for livestock foods, and the current practices of converting edible fish in tropical waters into fishmeal, needs to have a positive, forward-looking change of attitude towards the gainful use of such fish to satisfy future human survival needs, since fishing for food consumption is comparatively declining.

In developing countries the former attitude that the quick basis for the industrial development of fisheries can best be established through fishmeal production and other export products like lobster, shrimp, tuna is gradually giving way to the need for the industry to focus on domestic self-sufficiency in food. This has elevated the value and importance of fish as an important protein source and thus its transformation and presentation as highly acceptable hygienic product for human consumption. This change in policy is being brought about by higher import costs of food, inflationary costs of imported machinery and technology, the law of the sea portents and considerations and improved processing technology like meat and bone separators.

The shrimp trawling by-catch of fish is a resource which offers an opportunity for food supply from tropical sea areas adjacent to countries whose populations are short of fish supplies. Wherever the outflow of large tropical rivers deposit an alluvial outflow which enriches the bottom feed organisms on a broad continental shelf outspread,

the occurrence of large shrimp, sometimes called prawns, has given rise to shrimp trawling enterprises. For over thirty years such shrimp fisheries have been generally exploited by the "Gulf-of-Mexico" type of shrimp trawlers. These vessels which are mainly owned by American and Japanese companies have been designed exclusively to cater for the shrimp caught. However, large quantities of fish are caught incidentally in the fishing operation and this "by-catch" is discarded at sea, or, in a few cases, converted to animal feeds.

Joint ventures and international shrimp trawling companies now fish in the Gulf of Mexico, and South America, East and West Africa and Madagascar, the Indian coasts and the Southeast Asian seas. It has been estimated that the fish by-catch may total an annual average of 5 million tons of fish jettisoned in the tropical seas of the world while 1 million tons of shrimp are landed worldwide. A solution is therefore urgently needed to this problem so that more of the harvested products of the seas may be consumed and conserved by the populations of less privileged tropical coastal communities in the world's poorer countries.

The Problems

Because it is difficult for many to accept that such fantastic waste occurs, the complexity of the problem should be clearly explained. The vessels are designed with a refrigerated hold capacity of 15 to 30 tons of shrimp. They have a crew of 4 or 5, are highly powered (450 HP engines) and costly to operate. The capital cost of vessels varied from US \$150,000 to \$300,000 with operating costs and crew payments depending on their catch, efficiency and location. The vessels operating off Guyana generally made gross annual earnings of the shrimp catch equivalent to the initial investment on the vessel. This can only be done (with resulting profits to owners and crew) if the hold is filled with shrimp, not fish! Various factors (such as temperatures of the hold, numbers of the crew, and time at sea) are specially designed for handling shrimp. Further, the great bulk and variation of the fish that are caught make it impractical to accommodate the total by-catch with the present system. The value of this fish (about US 10 cents/lb average) compares adversely with shrimp (at least US \$1/lb). The fish is therefore thrown overboard!

The problem is not only economic but also technological. In the tropical seas the number of fish species caught in a trawl may be at least 20 and more generally 50. They are variable in size, chemical content (white or oily) and among the mixture some may be poisonous. The quantity of fish caught will vary with the place (bottom type, depth and currents); time of day (fish are generally more active in daylight than shrimp); time of year (the rainy seasons cause outflows from distant estuaries which affect the availability of fish). Generally the weight of shrimp caught varies between 10% to 30% of the total landed by the trawl. The bulk of edible fish is thus at least 3 to 9 times the amount of shrimp caught. As some species of fish become mature and gravid the chemical composition of the flesh and even its palatability varies. This mixed bag would be even difficult to process by reduction without some sorting between oily and white fish types. The crew aboard are too few to sort the bulk of fish since there is little time between the landing of the trawls. The operation is nocturnal.

For all practical purposes and operational efficiency, only the major quantities of acceptable market fish can be considered for collection aboard or easy processing ashore. Further, their availability must be assessed before industrial-scale processing can be considered. When such assessments were made along the Guyana shelf it was estimated that there was about 200,000 tons of consumable fish, involving 8 major "white-flesh" types, which can be obtained annually from the fleet of between 175 and 210 trawlers. By contrast the countries of the Caribbean import the equivalent of 150,000 tons of fresh fish annually. To test the practicality of using this fish the last few days' catch of marketable fish was required from each trawler coming to Port of Georgetown. This catch totalled annually about 2400 tons which was to be converted into fish products which had been traditionally imported (i.e. salted and smoked fish). Additionally fresh fish sales were increased.

However the sudden volume of fish brought into the market circuit created problems in the handling, processing, cold storage and

sales/distribution. This large through-put from trawl landings to the consuming public is not an easy transition in a tropical country unless an efficient industrial infra-structure for handling fresh or iced fish exists. With fish spoilage and wastes a spirit of frustrating discouragement feeds back both to the shore handlers and the fishermen who bring in the by-catch.

Additional products are being prepared from fish flesh of mixed species obtained through the use of meat and bone separators. It is planned that these comminuted fish products will form the basis of a new series of products to make use of the bulk of fish obtained as the trawler by-catch. The mixed fish flesh will thus not be readily identified as to species and form a new raw material from which hygienic edible products of both low-value and speciality types are made.

At the IDRC workshop held in Thailand (1974) similar situations were described in South East Asia. A parallel approach was being made through their fish technology laboratories in India, the Gulf of Thailand and Indonesia to solve the problem of the waste of the by-catch. It was pointed out that without any increase in fishing effort on the stocks of fish, more than 1 million tons can be thus available from the by-catch of shrimp trawling in that area.

Factors contributing to a solution

Since it is generally accepted that such a waste of consumable fish is unacceptable, solutions for its satisfactory use are being sought throughout the tropical world. These approaches are considering ways of handling the fish at sea; systems for collecting and transportation from shrimp trawlers and the processing of a mixed bag of species.

The development of shrimp/fish separator trawls had given promise that this could facilitate the sorting of fish at sea. Alternatives included the use of detached floating cod-ends; and/or refrigerated sea-water (R-S-W) tanks on the deck of trawlers into which the day's catch can be held. Both systems require the retrieval of the catch

by a collection vessel operating along with the fleet of conventional trawling vessels and landing their catch weekly. The collection vessel's storage at sea and transfer to port required a vessel with large but inexpensive refrigeration systems. The vessels with R-S-W-system used by the Pacific herring fleet in British Columbia are considered sufficiently adaptable for the exercise. However, until the bulk handling of the by-catch can be proven practical and efficient at low cost, industrial scale processing ashore will not be readily applicable since the landed costs of the fish will be too high (before processing) for low-income consumers which is the target population.

Processing of the mixed bag of fish has been experimented with using deboning machines which provided an extruded flesh quite free of bones, scales and skin. This waste can be converted to fish meal while comminuted fish flesh is now a new raw material, comprising of various species of fish which cannot be visually identified by the consumer. Tests have been conducted in the IDRC project in Guyana using the comminuted flesh to make dried, spiced, or salted products which are stable at normal temperatures and can be packaged in sealed plastic bags and sold at low cost. Additionally the project plans to make products of higher market value. That portion of the catch which comprises fish of high consumer demand (whether through species or size) is to be processed as fillets or specialty products. The higher value products are intended to contribute appreciably to the processing costs permitting the bulk preparation of the lower-cost stable fish products which can be within the reach of rural and remote communities where electricity and refrigerated household or market storage are not widely available.

It is noteworthy that such products have also been made in three laboratories in India, Thailand and Indonesia and it is urged that industrial scale enterprise should develop further their pilot operations using their locally designed machines. The products have a ready market acceptance.

Areas of Greatest Need

The often published figures of fish production and the gap in protein requirements of the tropical belt of the developing world emphasize the imposed obligation to utilize such incidental catches of fish, not for fish meal for livestock feeds or pet foods but for comestible fish products, for direct human needs. The catches off the western coasts of Africa and South America have been converted by fish protein-seekers into fish meal. This should be discouraged in the shrimp trawling by-catch.

The world population increase is posing an unparalleled food dilemma for the 21st century. While the world's fish production has increased in 1958 from 33.3 million tons to 66 million tons in 1973, though doubling in 15 years, there has been a decline in direct consumption pattern of fish from 84% of the landed catch to 60% with a comparative rise in the industrial processing (for fish meal etc.) from 16% to 40% of the total catch.

This means that the current trend is to convert to fish meal almost the equivalent quantity fish (26.2 million tons) as was previously directly consumed by man (28 million tons) 15 years ago. The agonizing corollary of this is that the increased catch converted into fish meal has largely come from the oceans adjacent to protein deficient countries (off Africa and South America) transformed and sold to feed the livestock of the affluent nations of the world of N. America and Europe (East and West).

There is a concern that the implications of the law of the sea will limit the fish production available to the traditional and powerful high-seas fishing nations of the world. The grave concern of the developing world is the higher cost of technology, of manufactured goods, services and fuel. The new focus of their attention is self-sufficiency in food, maximum home grown production, minimal waste, adequate employment! With these imperatives in the less developed

world a more humane perspective is required by advanced technology of the developed world. This should concentrate on areas such as the "waste" from the by-catch from tropical shrimp trawling as hygienic food for man.

It is urged that fish meal and industrial fish products should only be made from fish which is not otherwise caught or suitable for human consumption and from offal or trimmings from plant wastes. Fishing species which have direct consumption acceptance should be unacceptable on moral grounds since protein requirements for live-stock will be provided by other means.

It is submitted that this conference give some serious attention to this problem, which by its solution can bring into available circulation, an additional estimated 5 million tons of edible fish in the under-privileged areas of the tropical world now and in the 21st century. A comprehensive review with detailed references is being prepared on this subject.

Note: World production figures are based upon FAO's fishery statistics yearbooks.